BULLETIN OF MISCELLANEOUS INFORMATION No. 3 1930
ROYAL BOTANIC GARDENS, KEW

XII.—A VISIT TO KILIMANJARO. A. D. Cotton.

It is impossible for a botanist to visit or pass through Moshi in northern Tanganyika without experiencing an overwhelming desire to see something of the wonderful mountain of Kilimanjaro, which towers above him to the north. Its magnificent snow-clad dome, rising from arid plains to a height of 19,720 feet, is only 3 degrees south of the equator, so that its slopes exhibit extreme contrasts as to climate and provide one of the finest examples of tropical African mountain vegetation. It was fortunate, therefore, that whilst I was travelling in company with Dr. A. S. Hitchcock from Amani to Nairobi, the bi-weekly train service allowed us sufficient time to break the journey at Moshi and make a partial ascent of the mountain and yet fulfil our engagements at Nairobi.

Before describing this excursion and the vegetation as we saw it, it will be useful to make a brief statement as to the mountain itself and its botanical exploration in the past. As is well known, Kilimanjaro is the highest mountain in Africa. It is an extinct twin volcano consisting of the more ancient crater of Mawenzi, 17,570 ft., and the larger and more recent Kibo, 19,720 ft. (Strictly speaking it consists of three volcanoes, a still older crater of Shira having existed to the west.) The crater of Mawenzi is now a mass of ruins and consists of gaunt, jagged pinnacles and lava slopes of extreme steepness with little or no snow. Kibo on the other hand appears as a beautiful white dome. It is in reality a cone truncated as a crater, the inner central cone of which is now only warm enough to melt the snow which falls within it and prevent the formation of ice. The two peaks are separated by the " saddle " and are about five miles apart. Numerous small " parasitic cones " occur on the saddle and, especially on the south side, at various levels on the mountain mass and right down to the plain below. The general phanerogamic vegetation ceases between 13,000 and 14,000 ft., but lichens and occasional odd flowering plants occur as far as the saddle.

Though several references to mysterious snow mountains in East Africa occur in Arab writings, it was the missionary, Johann Rebmann, working for the C.M.S., who in 1848 first discovered and clearly described Kilimanjaro. Its earliest explorer was Baron der Decken, who made attempts to reach the summit in 1861 and 1862. He described in detail the dome-shaped crater of Kibo to the west, and the black jagged Mawenzi to the east. During his second

attempt he reached a height of 14,000 ft., and states that the general vegetation ceased at 12,000 ft. His plants are in the Berlin Herbarium, and he is commemorated in the name of the remarkable giant *Lobelia Deckenii* (Bot. Zeit. 1869, p. 71).

In 1871 the British missionary, Charles New, set out from Moshi and likewise made two attempts to attain the summit. On the second occasion he reached the snow line and collected a number of plants, amongst others the beautiful white *Helichrysum Newii*. He is stated to have " never dried a plant before," but was asked by Sir John Kirk " to do him the favour of cramming into any old book what he could of the highest vegetation of the mountain." A bundle of the " Guardian " served this purpose and his collection, which was presented to Kew, was described by Sir J. D. Hooker (Journ. Linn. Soc. xiv. pp. 141-146, 1874).

The geologist, Joseph Thomson, visited Moshi in 1883, and explored the Shira ridge to the west of Kibo, reaching a height of 9000 ft. In addition to his valuable geological contributions he made a collection of plants (now at Kew) which was the subject of a communication by Oliver and Hooker in the Journal of the Linnean Society (vol. xxi. pp. 392-406, 1885). His name is commemorated in the beautiful large white *Anemone* which is such a characteristic species in the high mountain meadows not only of Kilimanjaro but of Mt. Kenya and Mt. Ruwenzori.

Sir Harry Johnston's expedition of 1884, on behalf of the Royal Geographical Society and the British Association, was of more extended duration, since he stayed six months in the neighbourhood of the mountain. He brought home a large amount of material from the forest zone, but considering the time at his disposal he did did not collect a great number of mountain species. A list of his plants, which are preserved at Kew, was published by Oliver (Trans. Linn. Soc. ser. 2. vol. ii. pp. 327-355, 1887). The most noteworthy of the novelties was the arborescent *Senecio* named in his honour, the first representative to be discovered of that remarkable group of African plants.

Bishop Hannington, when sent out by the Church Missionary Society to form a Mission Station at Moshi, made collections in the Chagga region, but the most valuable of these were apparently lost. In a letter quoted in the story of his Life and Work, he states, "I have to-day sent to the British Museum a box of butterflies and a box of mosses from Kilimanjaro. . . . My plants all got spoilt with the intense rain, ferns and all, the mosses running a narrow shave." A few of his flowering plants from lower levels are to be found in the Kew Herbarium. Some botanical collections were also made by the Hungarian Expedition of Count Teleki and L. von Höhnel, and these, which were worked out by Schweinfurth, were presented to Berlin. According to Hans Meyer, the American naturalist Abbott reached, in 1888, the saddle plateau between Kibo and Mawenzi, and added to our knowledge of the flora and fauna.

The most notable scientific explorations of Kilimanjaro are those of the famous German traveller, Hans Meyer, who, at his own expense, made three separate expeditions from Europe in order to carry out geographical research and to conquer the peak which had hitherto defied all attempts. Reports on various aspects of his explorations are recorded in a number of works and papers. The most useful botanically is that dealing with his final and successful ascent which is found in the volume entitled " Across East African Glaciers ; an account of the First Ascent of Kilimanjaro " (a translation by E. H. S. Calder from the German, 1891). This volume, in addition to providing an historical and critical account of previous explorations and a full biography, includes a chapter on the physical geography with references to zones of vegetation, and provides as appendices systematic lists, by various German botanists, of flowering plants, lichens, mosses, and Hepaticae. His collection, which approached 500 numbers, is preserved at Berlin.

The expeditions of G. Volkens in 1893 and his subsequent account in the volume entitled " Der Kilimandscharo," 1897, are of special value since this explorer was a professional botanist who was already celebrated for his researches on the Egyptian desert. He gives a general account of the vegetation and distinguishes the following zones, which appear to be more natural than those proposed by Hans Meyer :—Steppe, Cultivated land, Mixed Forest, Forest Belt, Mountain Meadows and Lichen Region. His collection consisted of 800 numbers (Engler Bot. Jahrb. 18 : Beiblatt 46, p. 16, 1894), and was presented to Berlin, though very valuable series of duplicates are to be found in the Kew and British Museum herbaria. No enumeration of his plants appears to have been published, but the new species discovered are described in various works and especially in Engler's Pflanzenwelt Ost Afrikas (Teil C. Systematisches Verzeichniss, 1895).

In his monumental work " Die Pflanzenwelt Afrikas," Engler gives a comprehensive summary of the vegetation of German East Africa, and includes an account of the Kilimanjaro region, which had in the meantime been investigated by various German botanists, notably by himself and Uhlig (Band 1, Heft 1, pp. 226-345, 1910). Incidentally it may be mentioned that the finest photograph of a group of Kilimanjaro Senecios which has yet been published is to be found as Plate xviii. Later, in the section dealing with general geographical relationships, mention is also made of the subalpine and alpine regions of this area (pp. 935-936).

A series of excellent photographs of the cultivated belt, the forest belt and the mountain meadows, accompanied by a useful text, is provided by F. Tobler and G. Tobler-Wolf in Karsten and Schenk's Vegetations Bilder (Reihe xii. Taf. 7-18, 1915).

In the more detailed description of the African vegetation which Engler published in 1925, a considerable amount of space is devoted to Kilimanjaro, which he states is the best-explored mountain region

of East Africa (Die Pflanzenwelt Afrikas, Band v. pp. 250-267). He divides the vegetation into altitudinal " regions " and these, which differ slightly from the classification of Volkens, are as follows :—

1. The Steppe Region.
2. The Region of Mixed Forest.
3. The Region of Cultivated Land (extending from 1250–1720 m. on the south-east and west, and from 1700–1900 m. on the south).
4. Forest Belt (reaching up to 2700 m. on the east and up to 3000 m. on the south side, subdivided into a lower zone up to the commencement of *Podocarpus*, and a higher zone up to the *Ericinella* formation).
5. Subalpine Region, 2600–2400 m. (mountain meadows and " forest islands.").
6. Alpine Region (lower zone 3400–3600 up to 4200–4500 m. ; tufted grasses and cushion plants. Higher zone, 4200–4500 up to 5000 m. ; mosses, lichens and hydatophilous phanerogams in snow-water).

After a general account of each " region " Engler supplies a systematic list of species, and these lists (though they may require revision in the light of further research) provide the most complete and critical account of the flora yet published.

Several other smaller collections have been made during recent years, by far the most important so far as Kew is concerned being those of Mr. A. E. Haarer, an Agricultural Officer stationed at Moshi, who has during various periods of local leave studied not only the forest flora between Marangu and Bismarck Hut (8500 ft.), but also that of the Shira ridge on west Kilimanjaro, which rises to 11,000 ft. His collections have included several novelties and run into many hundred numbers. Miss E. Stuart-Watt also presented a small collection made in 1927, which is interesting in having been gathered from the slopes of Mawenza.

For a critical review of the various ascents to the summit and for a recent summary of our present knowledge of the mountain, reference may be made to W. Methner's paper, " Die Besteigungen des Kilimandjaro, Ein Historischen Uberblick " (*Mitt. aus der Deutschen Schutzgebieten* Bd. 34, Berlin, 1926-27, pp. 87-99), and to E. Klute's volume " Ergebnisse der Forschungen am Kilimandjaro " (Berlin, 1920) respectively, though botanical matters are but briefly touched on. Critical notes on various ascents will also be found in *The Alpine Journal*, vol. xl. pp. 77-84.

A very interesting and valuable account by Mr. C. Gillman, Chief Engineer of the Tanganyika Railways, will be found in the Journal of the Royal Geographical Society, vol. lxi, pp. 1-27 (1923). This deals primarily with an ascent he led to the crater rim in 1921. It contains many geographical and geological notes as to the mountain itself and numerous references to plants and vegetation. Mr. Gillman emphasises the immense economic significance of the

forest belt. He points out that the innumerable streams, some of which are of considerable size, which flow down the mountain and fertilize the cultivated Wachagga zone and the European plantations at Taveta and elsewhere, are only to a small extent glacier-fed. The meteorological records show this clearly. The function of the forest in condensing the vapour brought by the Trade winds from the Indian Ocean and storing the moisture in the layer of humus is infinitely more important than the relatively small precipitation on the rocky slopes above the forest or the moisture stored in the ice-cap of Kibo. In the interests of both European and native cultivation, the importance of preserving the forest belt cannot be over-emphasised. As Mr. Gillman says, "every further acre cleared up there means irrevocable distress further down in years to come."

The opportunity of ascending Kilimanjaro during my official tour was quite unexpected, but having the chance of doing so I resolved to take full advantage of the occasion and to see as much as possible of the mountain itself and its remarkable flora. The ascent can be most easily made from the village of Marangu in the Chagga country on the south side of the mountain, where there has now been opened a small but comfortable hotel (about 4000 ft.). Starting from that elevation with four days at our disposal we were able to reach an altitude of over 12,000 ft. (Dr. Hitchcock to nearly 14,000), and to return to Marangu without undue fatigue. The ascent as far as the saddle is gradual and perfectly easy, and with another day there would have been no difficulty in more thoroughly exploring the limit of phanerogamic vegetation.

With no equipment but a press borrowed from Amani, and with no expert knowledge of the flora, I anticipated that four short days would only permit one to gain some first-hand knowledge of the vegetation and collect a few specimens for the Kew Herbarium. These expectations were, however, more than fulfilled. The small collection of 80 numbers made from 8500 ft. upwards not only added specimens of species sparsely represented in the Herbarium, but supplied material of several others not represented at all, and also three species and one variety which are described as new in the following pages, though two of these were already known but had not been recognised as distinct. In addition seeds of various species, and living plants of a new giant *Senecio*, were brought home to be grown at Kew.

As will have been noted from the historical résumé, there are several recent accounts in German works of the flora and vegetation of Kilimanjaro, but no botanical work has appeared in English since the translation, nearly 40 years ago, of Hans Meyer's work. An additional reason for the publication of the present paper lies in the fact that the particular route we followed is likely to be used in the future by botanists from Amani, Nairobi, and elsewhere, and hence a record in the *Kew Bulletin* may be useful. Owing to the much

steeper slopes and lower rainfall on the north side of the mountain, the vegetation belts are much narrower and less luxurious than on the south side, hence the ascent outlined below, in addition to being the more easy, is also much more interesting botanically.

The recently opened " Kibo Hotel " at Marangu serves as an excellent base. The proprietor owns the two rest houses or huts on the mountain, namely Bismarck Hut at 8500 ft. and Peter's Hut at 11,500 ft. altitude, built in 1910 by Dr. Foerster, a Moshi settler. He provides all that is necessary in the way of a guide, porters, food, and blankets, also donkeys if required. Expert advice moreover can be obtained from Dr. Richard Reusch, of the Leipsiger Lutheran Mission, who has ascended the summit no fewer than eight times. Our retinue consisted of a cook, and four porters, who marched erect and with ease with 40 lbs. loads balanced on their heads.

On leaving Marangu the path traverses a wide belt of native cultivation which with the fertile soil and regular rainfall, aided by an elaborate system of irrigation, is remarkably luxuriant and healthy. It consists, as seen from the path, chiefly of banana, coffee, maize, cassava, pawpaw and *Ricinus*. A little yam, sugar cane, millet and *Eleusine* (for brewing) are also grown, and the coffee is interplanted with dwarf beans. Amongst the native flora a bramble and the common bracken were abundant, and the beautiful large-flowered *Hypericum lanceolatum* occurred in quantity. A striking feature is the use of *Dracaena Steudneri* planted so closely as to form hedges around the plantations. The Wachagga people (allied to the Masai) who in their beehive huts inhabit this country are prosperous and contented, and, owing to the civilizing influence of the German missions and European administration, their condition differs markedly from that described by Sir Harry Johnston.

After about 1½ hours' walk, the native cultivation ceases and one plunges into the primeval forest. With an altitude approaching 6000 ft. the conditions are those of a temperate rather than a tropical rain-forest. At first there is little undergrowth, but the ground vegetation soon becomes thick, and is, but for the path, almost impenetrable. The tall trees consist of a variety of species and intertwined amongst them are lianes and creepers, the whole being festooned with a great variety of epiphytes. Beneath the trees is a mixed undergrowth in which Piperaceae, *Begonia*, *Cyathea* and *Marattia* are conspicuous. The growth of immense quantities of *Adiantum*, *Hymenophyllum* and other ferns, and long streamers of mosses, testify to the cloud-belt and abundant precipitation. The ground is carpeted with sheets of *Selaginella* and Lycopods, through which push the flowers of various small Balsams and *Gesneriaceae*. In the moss on the trees, orchids and the small violet-coloured *Streptocarpus montanus* were abundant, and along the path isolated

specimens of the common British *Sanicula europaea* were observed.* A noteworthy feature of the Kilimanjaro forest is the entire absence of the bamboo belt (*Arundinaria alpina*) which is such an interesting feature of the vegetation of Mt. Kenya, Mt. Elgon, Mt. Ruwenzori, and many other African mountains.

About half way through the forest belt the epiphytic ferns gradually gave place to lichens, especially *Usnea barbata* and other well-known species, and these continued to festoon the upper branches of the trees until the forest was succeeded by mountain meadows. As the forest growth became less dense, more attention could be given to the individual trees. A species of *Podocarpus* (probably *P. milanjianus*) and *Hagenia abyssinica* were noticeable, and shortly afterwards *Erica arborea* and a very tall growth of *Hypericum lanceolatum* were abundant. Open patches (possibly representing clearings due to burning by natives) became frequent, and in one, particularly, the tall spikes of a bright crimson *Gladiolus* (*G. Quartinianus*?) against a background of tall green grass made a charming picture. That this habitat was the natural one for this species of *Gladiolus* was evident from its vigorous and deep green leaves, which were in marked contrast to plants of the genus often seen at home. Other plants in flower in the long grass were a dark blue *Sisyrinchium*, *Tritonia Thomsonii*, and several ground orchids. As the track approached Bismarck Hut most of the trees and plants hitherto met with disappeared and almost pure communities of *Erica arborea* and *Hypericum lanceolatum*, with tussocks of *Festuca*, constituted the dominant vegetation.

Bismarck Hut (8500 ft.) was reached at 2 p.m. after five hours' easy walking. A dense, driving wet mist then set in, but specimens of plants (excluding trees) were collected, principally in the more open ground immediately in front of the hut. These consisted of the following species in addition to those plants mentioned in the last paragraph :—*Blaeria glutinosa* (4)†, *Philippia keniensis* (6), *Stoebe kilimandscharica* (2), *Hebenstreitia dentata* (41), *Helichrysum abyssinicum* (11) not in flower, and the beautiful rose-coloured *H. Meyeri-Johannis* (13).

The stone-built Bismarck Hut is provided with two rooms, four iron bedsteads and a stove, with a separate room for porters. It was

* This plant is noteworthy as being the only flowering plant noticed (Engler lists also *Anthriscus silvestris*), amongst the vast assemblage of unfamiliar species in the forest, which appeared to be the same as anything known in Britain. The species as at present understood is well known to have a very wide distribution and the specimen brought home is regarded as identical with British material. It has been recorded from the Himalayas, the mountains of Yunnan, Manchuria and Corea and from the Malay Islands. In Africa apparently the same species has been collected at altitudes varying from 4000 to 10,000 ft. in the Cameroons, Fernando Po, Abyssinia, Uganda, Kenya, Usambara, Nyasaland and Gazaland, and has been recorded also at lower altitudes in Madagascar and S. Africa.

† The collection is deposited in the Herbarium at Kew. The numbers in brackets after the botanical names refer to the serial field numbers of the collection.

dry and clean though sparsely furnished, thefts in the past not encouraging the hotel proprietor to supply tables or chairs. It proved a welcome retreat that evening, our most vivid recollection of the exterior being the long streamers of *Usnea*, on *Brayera* and *Podocarpus*, blown almost horizontally in the driving rain.

By morning, only mist prevailed, and a start was made for Peter's Hut. The track, which passed through another patch of forest, was steep and slippery. A great number of additional plants, chiefly herbaceous, were observed, but since our object was to collect on the higher ground and to reach Peter's Hut, practically no specimens were taken. Plants of *Plectranthus*, *Pycnostachys*, *Pentas carnea* and *Geranium vagans* (8), were, however, specially noted, and *Viola abyssinica* var. *Eminii* (12) in abundance. After about half an hour open ground was reached again, though islands of forest continued to occur. Owing to the mist, the general view of the vegetation and of the grandeur of the scene was lost.

The mountain meadows consisted of tussocks of *Festuca* and other grasses, the bulk of which were not in flower. Scattered between the grass tussocks were a number of brightly coloured flowers, notably *Antholyza* and *Gladiolus* (probably *G. Quartinianus*), *Helichrysum Meyeri-Johannis*, *Dierama cupuliflorum* (17), in varying shades of pink and mauve, *Anemone Thomsonii*, with its white perianth suffused with rose on the outside, and *Tritonia Thomsonii*, specimens of which were dried, only to fall to pieces after a few days. In the short grass on the track itself were the gentian-like *Swertia crassiuscula* (39), the colour of which varied from a deep blue to dirty white, and the exceedingly delicate *Wahlenbergia kilimandscharica* (14).

At this level also (about 9500 ft.) *Protea kilimandscharica* was observed for the first time. It occurred in groups or extensive societies usually in company with ericaceous or other woody plants, and was met with up to the level of Peter's Hut. The largest plants noted were about 8 ft. high. Severe dying back of the branches was very characteristic, and was probably due to the effect of intense wind coupled with physiological drought. A few flowers, creamy white in colour, were noted at intervals during the day.

The grassland vegetation of the mountain meadows was interrupted here and there by extensive tracts of ericaceous scrub. The dominant species appeared to be the *Protea* referred to, *Erica arborea* and *Adenocarpus Mannii* (42), with lesser quantities of *Blaeria glutinosa*. The general habit of *Adenocarpus* much resembles gorse (*Ulex europaeus*), and the likeness extends to its yellow flowers, small black pods, and narrow pointed leaves. Another striking plant in the scrub vegetation was *Anthospermum usambarense* (23), its dark, stiff, erect shoots resembling in miniature those of a Cypress. Scattered amongst the scrub were odd specimens of *Artemisia afra* (43), *Hebenstreitia dentata*, and *Scabiosa Columbaria* (29).

The plants for which Kilimanjaro is most noted, the giant *Lobelia Deckenii* and the giant *Senecio*, began to appear at about

10,000 ft. The former occurred plentifully as scattered plants in the scrub, and the latter always in damp ground. *Lobelia Deckenii* was not in flower at the time of our visit but occurred as short rosettes about 1 ft. high, though some plants bore old inflorescences from which seed was taken for Kew. *Lobelia Volkensii*, which occurs in the forest belt at the lower elevations, was not seen. (*See* R.E. and Th. C. E. Fries, Die Reisen-Lobelien Afrikas, in Svensk Botanisk Tidskrift, xvi, pp. 383-416, 1922.)

The arborescent Senecios are even more impressive and singular in appearance. Isolated examples 8-10 ft. high in ravines or beside streams were first noted. These were unbranched, with trunks, owing to the presence of persistent leaf bases, nearly 2 ft. in diameter. Higher up they occurred in groups and were repeatedly forked and very much taller. One particularly large colony occurred in a bog to the left of the track. The bog consisted of coarse grass-tussocks and was carpeted with dense sheets of *Alchemilla argyrophylla* (observed first at this level). It was traversed by deep winding channels which were so completely hidden by the grass and *Alchemilla* as to be dangerous, and an hour was spent in endeavouring to get sufficiently near the Senecios in order to take photographs. (Plate IV, fig. 1*). The trunks were even thicker than those previously seen and in several cases the leaf-bases and bark had rotted away and only gaunt, smooth, woody cylinders, forked 2 or 3 times, and 15 ft. in height, remained. No flowers were present, and owing to their inaccessibility specimens of leaves were not collected. We assumed the species to be the "berühmter *S. Johnstonii*" of which we had heard so much at Marangu. The view from this spot was finer and more rugged than hitherto and the hillside well furnished with interesting plants, so that the swamp with its colony of arborescent Senecios and background of Ericaceae and *Protea* stands out in our memories as one of the most majestic and interesting features of the climb.

The mist had now entirely dispersed from the higher altitudes and for the rest of the day there was brilliant sunshine. Since the afternoon was wearing on and we were uncertain as to whether further delays might be incurred we pushed on to Peter's Hut, not pausing to collect. The grassland gradually ceased, giving way to rugged ground consisting of blocks or slabs of lava with patches of scrub which became ever shorter as the climatic conditions became more severe. A considerable amount of colour was added by the increase in the number of both species and individuals of *Helichrysum*, and the area around Peter's Hut was as gay with flowers as any part of the mountain. On the way Mt. Meru, some 70 miles to the south-west, was sighted and some fine views were obtained of the old broken-down crater of Mawenzi, to the north.

* Acknowledgments are due to the United States Department of Agriculture for the three photographs illustrating this paper, which were taken by Dr. A. S. Hitchcock.

The hut itself (11,500 ft.), which was reached at 4.30 p.m., is a well-built wooden and galvanised iron structure consisting of one large room with four beds arranged bunk fashion, and separate accommodation for porters at the rear. The hut faces down the mountain to the south or south-east, and Mt. Kibo is clearly visible at the back in a north-westerly direction. Being on the open mountain-side away from the gloom of the forest and the cloud belt, it is a much more cheerful spot to encamp in than Bismarck Hut. About 6.15 darkness fell suddenly, but before this there was a magnificent sunset effect. The vast billowy waste of clouds below us, which hitherto had been white, suddenly became bright pink, and, as the light faded, turned rapidly grey.

The next morning brought another transformation. All the cloud had gone and a map of Africa appeared to be spread out in front of the hut, or rather as if it stood up before us in the sky. On turning out at 7 a.m. to wash in the stream close by, the ground was found to be coated with a firm crust due to frost, and the leaves of a giant *Senecio*, which proved to be a new species, were stiff and coated with rime. A remarkable sight also was the blaze of colour shown by the yellow Helichrysums and other plants against a background of black lava rocks and white hoar frost.

The day was spent collecting in the neighbourhood of the hut and up to about 500 ft. above it. The dominant plants amongst the lava blocks around the hut are Helichrysums and other composites, and of these by far the most striking is *Euryops dacrydioides* (60) with bright yellow flowers and lycopodioid foliage. Other conspicuous species were two white Helichrysums, *H. Newii* (18) and *H. Hoehnelii* (19), the beautiful yellow *H. abyssinicum*, and *Senecio Schweinfurthii* (24), with Coltsfoot-like yellow flowers and the scent of *Petasites fragrans*. Another woolly, yellow species, *H. fruticosum* var. *compactum* (22), was still plentiful and in flower at this altitude (which was not the case at lower levels), and also the yellow-brown *H. Kilimanjari* (52) which, according to New, reaches right up to the snow line. *Hebenstreitia dentata* (23), first observed below Bismarck Hut, also occurred here in quantity, though shorter in height and exhibiting various shades of colour, chiefly pink or with a deep crimson blotch as noted by Sir H. Johnston. Two prostrate plants were abundant amongst the rocks, *Alchemilla Johnstonii* (46), a woody species with few very inconspicuous flowers, and *Geranium kilimandscharicum* (29), with small pink flowers and brilliant crimson foliage. Occurring as scattered individuals amongst this vegetation were *Tritonia Thomsonii*, *Valeriana kilimandscharica* (50), *Bartsia Petitiana* (37) and *B. kilimandscharica* (38), *Micromeria biflora* (53), *Selago Johnstonii* (47) and *Scabiosa Columbaria* (26). The scrub amongst the windswept lava blocks around Peter's Hut was dwarf and exhibited much dying back of the branches. It consisted of *Erica arborea*, *Blaeria Meyeri-Johannis* (31), both of which were in flower, and *Philippia Johnstonii*

(30) with dead flowers, and much weather-worn *Protea kilimandscharica*, which occurred occasionally as a pure community and displayed old flower-heads even at 12,000 ft.

The same type of flora persisted above the hut, the limit of general vegetation, according to Dr. Hitchcock, being about 13,500 ft. No additional species other than grasses were observed by him in the higher levels. Giant Senecios were seen on the sides of a stream and Miss E. Stuart-Watt informs me that she has seen, well above the hut, a considerable quantity of this plant, and also *Lobelia Deckenii* in wet ground, the water of which was covered with ice. On reaching the edge of the plateau, before the saddle, only a few grasses and species of *Helichrysum* remained. According to Hans Meyer an odd species of *Euryops* was found at 14,210 ft. (op. cit. p. 139) and a *Helichrysum* at 15,260 ft. (p. 152). The "lichen region" of Volkens sets in at about 13,500 ft., and Hans Meyer found lichens on Kaiser Wilhelm's Peak at the actual summit (p. 324).

Whilst Dr. Hitchcock proceeded on the rough ground to the plateau, I examined the flora of the ravine close to the hut, working upwards in the morning and downwards after lunch. As shown by the bed of the stream the volume of water coming down was obviously less than it had been but probably not so slight as at certain seasons. In the grass sward in and at the sides of the stream several water-loving plants were found. Young specimens and also old inflorescences of *Peucedanum Kerstenii* (32) were common. Amongst the smaller species two of the most conspicuous were plants of rosette habit with bright yellow flowers, the rosettes being as closely adpressed to the ground as in *Pinguicula*. The most common was *Ranunculus oreophytus* (51), the peduncle of which after flowering is positively geotropic and pushes the young achenes down on to the soft ground. The other proved to be an undescribed species of *Landtia*, since named *L. kilimanjarica* Hutch. and Moss. It was found subsequently that the same plant had been collected on the Shira Mountains of Kilimanjaro in 1928, by Mr. A. E. Haarer, and also by Volkens in 1894 when it had been named by Engler *Arctotis Rueppellii* O. Hoffm. It grows on slightly drier situations than the *Ranunculus* and like that plant is very firmly anchored in the ground by means of a few long, strong, fleshy roots. Other small plants in the ravine were *Senecio sympodialis* (54), *Swertia crassiuscula* (40), *Arabidopsis Thaliana* (55), and an *Arabis*, much resembling the common *A. alpina* of Europe, which was found to be *A. cuneifolia* var. *merutensis* (49). These were flanked on the sides by the same species of *Anemone* and *Scabiosa* which occurred below. On rocky ledges, a few plants were seen which had not been noted before, namely, a yellow *Sedum, S. Meyeri-Johannis* (61), an elegant yellow *Cineraria, C. kilimandscharica* (28), and the exceedingly beautiful pink *Helichrysum Lentii* (21), a species very much resembling *H. Meyeri-Johannis* of the lower altitudes. The widely distributed fern *Asplenium praemorsum* was also prevalent. At slightly lower

levels a few specimens of *Trifolium Johnstonii* were noted, and the rosette Umbellifer *Trachydium abyssinicum* (48) was abundant in short grass in the damp areas.

The new arborescent *Senecio*, named *S. Cottonii* Hutch. & Taylor, grows on rocky ground (Plate IV, fig. 2, Plate V). It was at the time regarded as *S. Johnstonii*, but was recognized by Mr. Hutchinson as differing from that species in the leaves having a permanent thick coat of woolly hairs, an entire instead of strongly toothed margin, a rounded instead of markedly cordate base, and in possessing a broad and downy petiole. The capitula differ moreover in being larger and containing fewer ray florets. It is in reality more closely allied to *S. Battiscombei*, which occurs at similar altitudes on Mount Kenya ; from this it differs in the very short ligulate florets. The plant from which the leaves were collected (35) was from a group in the ravine above the Peter's Hut level, and the young living plants (36) which were brought home to Kew* were in the immediate vicinity of these large specimens. The inflorescence (34) was collected from a plant at a higher level by Dr. Hitchcock.

As this *Senecio* was not at the time recognised as distinct from *S. Johnstonii* it is unfortunately not possible to state its exact altitudinal distribution. It is, however, almost certainly a high mountain plant and occurs at a higher level than *S. Johnstonii*. No specimens which can be referred to it were to be found in the Kew Herbarium, or in the incorporated collections of the British Museum. It is not, moreover, represented in the Kilimanjaro material at Berlin kindly sent on loan by Dr. Diels. After Mr. Hutchinson's description had been drawn up, Mr. G. Taylor, of the Natural History Museum, brought specimens of the same species to Kew for comparison. This gathering, which from the literature he had decided was an undescribed species, was made on Kilimanjaro by Messrs. Piemeisel and Kephart on behalf of the U.S. Department of Agriculture in August, 1927. The material of the two gatherings agrees precisely, and since Mr. Taylor's decision was practically simultaneous with Mr. Hutchinson's, joint authorship for the description was decided upon. Further notes on *S. Cottonii* and on the other species of arborescent Senecios are given by Mr. Hutchinson on pp. 117, 118.

The present account and the list which follows, by adding a few new facts, aim only at carrying our knowledge of the flora and vegetation of African mountains a step farther and thus stimulating further investigation. No attempt is made at generalizations or speculations as to the origin of the flora or succession of the vegetation units. The most striking general features of the mountain are the coarse nature of the plant-covering and the extreme paucity of

* The young plants were dug up with a good ball of earth, packed with leaves upright in a flat tin and were kept (whenever possible) in light but shady conditions for the next 12 days, when they were placed in cool storage on the steamer at Mombasa. After 19 days in complete darkness they were unpacked at Kew and were apparently in a perfectly healthy condition.

FIG. 1. *Senecio Johnstonii* in channels in marsh at about 11,000 ft. Ericaceae and Protea Scrub in background.

FIG. 2. *S. Cottonii* on rocky ground at about 13,000 ft.

Photos: A. S. Hitchcock.

CRUCIFERAE.

Arabis cuneifolia *Hochst.* var. **meruensis** *O. E. Schulz* in Notizbl. Bot. Gart. Berl. 9 : 1106 (1927).

In ravine on ground near Peter's Hut, 11,500 ft., No. 49.

Recorded from Abyssinia, Kenya (from 10,000–13,200 ft.) and the Aberdares (9000 ft.).

Arabidopsis Thaliana *Heynh.* –*O. E. Schulz* in Engl. Pflanzenr. 4, 105 : 270 (1924). *Sisymbrium Thalianum* Gay et Monn.—F.T.A. 1 : 63.

Near Peter's Hut, 11,500 ft., No. 55.

Also recorded from Abyssinia (6000–6600 ft.) ; common in Europe and temperate Asia, occurring in N. America, Australia and at the Cape.

VIOLACEAE.

Viola abyssinica *Steud.* var. **Eminii** *Engl.* Pflanzenw. Ost-Afrikas C : 276 (1895).

Very abundant in forest around Bismarck Hut, 8000–9000 ft., No. 12.

This rounder-leaved variety is also recorded from the Aberdare Range and base of Kenya, from Elgon (9000–10,000 ft.), and Ruwenzori (11,000 ft.).

CRASSULACEAE.

Sedum Meyeri-Johannis *Engl.* Hochgebirgsfl. Trop. Afrika 229 (1892)—ex descriptione.

On rocky ledge in ravine at Peter's Hut, only specimen seen, No. 61.

Apparently confined to Kilimanjaro ; the original was collected by *Hans Meyer* about 8400 ft. growing amongst moss, but has since been found at higher levels.

GERANIACEAE.

Geranium vagans *Baker* in Kew. Bull. 1897 : 246.

In forest around Bismarck Hut, 8500 ft., No. 8.

Originally described from the Nyika Plateau in Northern Nyasaland (6000–7000 ft.), and lately also collected from Bismarck Hut by *Haarer* No. 181. The whole plant is viscid and has an unpleasant odour.

G. kilimandscharicum *Engl.* Hochgebirgsfl. Trop. Afrika 274 (1892)—ex descriptione.

Abundant below and around Peter's Hut, 10,500–11,500 ft., foliage brilliant crimson, flowers small, pale pink, No. 29.

Recorded from the Shira Mountains (12,000 ft.) by *Haarer* No. 1142, and from the Aberdares by *Dowson* No. 99.

PROTEACEAE.

Protea kilimandscharica *Engl.*—F.T.A. 4, 1 : 198 ; Engler 195.

Near Peter's Hut at 11,500 ft., extends from 9000 to 11,500 ft., No. 70.

This species, closely allied to the more widespread *P. abyssinica* Willd., has also been recorded from Elgon, Rutundu slopes and N.E. Kenya, covering large areas (9000–11,000 ft.), and the Kyimbila District, north of Lake Nyasa.

ROSACEAE.

Alchemilla argyrophylla *Oliv.* in Trans. Linn. Soc. Bot. Ser. 2, 2 : 333, and in Hook. Ic. Pl. t. 1505 ; Engler 237.

In wet ground, near group of giant *Senecio*, 10,500 ft., No. 45.

Recorded from the Aberdares (9500–11,100 ft.), the Kenya moors, making a dense covering over large areas, and the Shira Mountains (10,000 ft.).

According to *J. C. Rammell* the Kikuyu vernacular name for this plant is " Kitamuhera," so called because if trodden on it rises again after the foot has been taken away.

Alchemilla Johnstonii *Oliv.* in Trans. Linn. Soc. Bot. Ser. 2, 2 : 333, and in Hook. Ic. Pl. t. 1504 ; Engler 237.

Below Peter's Hut, and very abundant from about 10,500 to 11,500 ft., No. 46.

Apparently this species has not been recorded from any other locality.

PAPILIONACEAE.

Adenocarpus Mannii *Hook. f.*—F.T.A. 2 : 47 ; Engler 249 ; Hutch. et J. M. Dalz. Fl. West Trop. Afr. 1 : 399.

In heather association between 10,000 and 11,000 ft., No. 42.

Recorded from the Aberdares (7000–9000 ft.), Ruwenzori (7000–8000 ft.), the Shira Mountains (9000 ft.), Pare District (6500 ft.) and the mountains of Nyasaland ; this species is also abundant in West Tropical Africa, on Cameroons Mountain above the forest line (up to 12,000 ft.), Fernando Po (9000 ft.), and also on Bambuto Mountains, Cameroons.

Trifolium Johnstonii *Oliv.* in Trans. Linn. Soc. Bot. Ser. 2, 2 : 331 ; Engler 252.

Found at 11,000 ft., No. 59.

Apparently fairly widely distributed in the mountains of East Africa, but the species of this genus require critical study. A good stock food.

UMBELLIFERAE.

Sanicula europaea *L.*—F.T.A. 3 : 8 ; Engler 316.

In rain forest between 6000 and 8000 ft., No. 1.

Occurring in forests, open glades and damp places in the mountains of tropical South Africa, in moist situations in Europe (see footnote on p. 103).

Trachydium abyssinicum *Benth. et Hook. f.*—F.T.A. 3 : 10 ; Engler 317.

Forming flat rosettes on bare ground below Peter's Hut at an altitude of 11,000 ft., No. 48.

Found on the mountains of Abyssinia, the Aberdares, summit of Kinangop Mountain and Nandi Plateau, and on the Shira Mountains.

Peucedanum Kerstenii *Engl.* in Bot. Jahrb. 19, Beibl. 47 : 43 (1894). *P. dissectum* Dawe, nomen.

In ravine near Peter's Hut, No. 32. Young plants and plants bearing old inflorescences found at about 12,000 ft.

Also recorded from the Aberdare Range (11,000 ft.), Ruwenzori (9000–11,000 ft.) and the Shira Mountains (approximately 10,000 ft.).

ERICACEAE.

Erica arborea *L.*—F.T.A. 3 ; 483 ; Engler 324.

Extends from below Bismarck Hut in pure communities, reaching a height of 20 ft., to just above Peter's Hut at nearly 12,000 ft., Nos. 5 and 58.

A widespread species, found also in Abyssinia (up to 10,500 ft.), British Somaliland and Eritrea, in the mountainous regions throughout East Tropical Africa (6900 to 13,000 ft.), the Atlantic Islands and South Europe.

Philippia keniensis *S. Moore* in Journ. Bot. 1901 : 259. *Ericinella Mannii* Auct. non Hook. f.

Tall and abundant below Bismarck Hut, at 8500 ft., reaching a height of 15–20 ft., No. 6.

Also collected from the Aberdare and Kinangop Mountains (10,000 ft.). Fries points out that the "Ericinella Mannii" of Kilimanjaro referred to by previous writers is quite distinct from the true *E. Mannii* which is confined to W. Africa.

Philippia Johnstonii *Engl.* Pflanzenw. Ost-Afrikas C. : 302 (1895).

Scarce in flower above Peter's Hut, 12,000 ft., No. 30.

Recorded also from Mount Kirungu (*Kassner*) and Ruwenzori (in open places in bamboo forest at 8600 ft. and reaching an altitude of 12,000 ft.).

Blaeria glutinosa *K. Schum. et Engl.* in Engl. Hochgebirgsfl. Trop. Afrika, 327 (1892).

Tall bushes in flower near Bismarck Hut, 8500 ft., and extending to Peter's Hut, 11,500 ft., also in flower, Nos. 3 and 4.

Apparently confined to Kilimanjaro ; collected by *Volkens* (No. 939) from the Kifinika volcano at an altitude of 9300 ft., and below Kibo (10,500–14,000 ft.) by *Hans Meyer* Nos. 100 and 235.

Blaeria Meyeri-Johannis *K. Schum. et Engl.* in Engler 326.

Peter's Hut, 11,500 ft., No. 31.

This species has previously only been collected from Kilimanjaro slopes by *Volkens* and from the Shira Mountains (12,000 ft.) by *Haarer*.

RUBIACEAE.

Pentas carnea *Benth.*—F.T.A. 3 : 46 ; Engler 398.

In forest clearings at 8000 ft., No. 7.

From Abyssinia, Uganda, common on the Aberdares and Mount Kenya, and also from Ruwenzori (amongst heather, 9000 to 11,000 ft.).

Anthospermum usambarense *K. Schum.* in Engl. Bot. Jahrb. 28 : 112.

Of erect stiff habit, scattered in *Erica* scrub from 10,000 to 11,000 ft., No. 23.

This heath-like plant has been recorded from Mount Kineti, Southern Sudan, where it forms the highest scrub on the mountain top, 10,500 to 11,000 ft. (*Kew. Bull.* 1929 : 191) ; also from the Aberdares, in moorland or outside forest at 9000 ft., and on the highest ground on Mau Plateau (8500–9500 ft.).

VALERIANACEAE.

Valeriana kilimandscharica *Engl.* Bot. Jahrb. 19, Beibl. 47 : 48.

Below Peter's Hut, 11,000 ft., No. 50.

Found on Elgon (13,000–14,000 ft.), and also on the Shira Mountains (about 13,000 ft.).

DIPSACACEAE.

Scabiosa Columbaria *L.*—F.T.A. 3 : 252 ; Engler 404.

Below Peter's Hut, 11,000 ft.

Common in the higher parts of Africa and the East, Europe, etc.

COMPOSITAE.

Conyza apiculata *Hutch. et M. B. Moss*, sp. nov. ; aspectu *C. ruwenzoriensis* R. E. Fries, sed affinis *C. incanae* Willd., foliis haud lobatis basi late auriculatis supra subglabrescentibus capitulis numerosioribus differt.

Herba erecta, parce ramosa ; caules longitudinaliter striata, laxe lanato-tomentosa. *Folia* lineari-lanceolata ad lanceolata, acuta et acute apiculata, sessilia et basi late auriculata, marginibus recurvatis, 2·5–4 cm. longa, circiter 5 mm. lata, utrinque praesertim infra laxe lanata, supra subglabrescentia. *Inflorescentia* terminalis, cymoso-paniculata, usque ad 8 cm. diametro. *Capitula* cupularia, circiter 8 mm. diametro. *Involucri bracteae* lanceolatae, acutae, circiter 4 mm. longae, marginibus et costa media dorso longe lanatae. *Flores* ♀ 2 mm. longi ; ligulae minutae, circiter 1 mm. longae. *Flores* ♂ numerosi ; antherae basi integrae. *Achaenia* parce pubescentia. *Pappus* minute scabridus.

Tanganyika Territory : Kilimanjaro ; in open ground below Bismarck Hut, 8500 ft., *Cotton* No. 9 ; *Volkens* No. 1299 ; upper margin of forest above Kiboscho, 9300 ft., *Volkens* No. 1517 ; Shira Mountains, approximately 10,000 ft., *Haarer* No. 1147 (type).

Helichrysum Meyeri-Johannis *Engl.* Hochgebirgsfl. Trop. Afrika 427 (1892).

In open ground round Bismarck Hut at an altitude of 8500 ft., No. 13. *Johnston* No. 16 ; *Volkens* No. 778.

This beautiful pink species occurs also on Elgon where it is frequent on moorland round the crater at 13,500 ft. It is a much smaller plant than the closely allied species *H. Lentii*, and differs from it by the rosette habit, creeping branchlets, smaller spathulate leaves, and the capitula smaller and fewer in each inflorescence.

Helichrysum Lentii *Volk. et O. Hoffm.* in Engl. Pflanzenw. Ost-Afrikas C : 410 (1895).

In ravine below Peter's Hut, 11,500 ft., No. 21.

Closely allied to the last species, this plant has been recorded previously from Mount Kenya and Ruwenzori.

Helichrysum Newii *Oliv. et Hiern.*—F.T.A. 3 : 349 ; Engler 425.

Around Peter's Hut at 11,500 ft., No. 18. Found also on Kilimanjaro by *C. New, H. H. Johnston* No. 112, and by *A. E. Haarer* No. 1135 on the Shira ridge.

On the summit of the Kinangop Mountain (12,000 to 12,750 ft.), on Mount Kenya, frequent on moorland round the Elgon crater (13,500 ft.). According to *Meyer* the straw-coloured flowers of this species gathered at 14,200 ft. represent the last flowering plants seen on Kilimanjaro.

Helichrysum Hoehnelii *Schweinf.* ex *Engl.* Hochgebirgsfl. Trop. Afrika 426 (1892).

Around Peter's Hut, 11,500 ft., No. 19.

Recorded from the Kinangop Mountain (on the summit of the Priory Rock at 12,760 ft.), this species grows abundantly on the moorland round the crater of Elgon (13,500 ft.), and is also found on the Shira Mountains (14,000 ft.).

Helichrysum abyssinicum *Sch. Bip.*—F.T.A. 3 : 351 ; Engler 428.

Bismarck Hut, No. 11, extending to Peter's Hut, 11,500 ft., No. 20.

Commonly occurring in the mountains of Abyssinia.

Helichrysum fruticosum *Vatke* var. **compactum** *Vatke* in Linnaea 39 : 491 (1875) ; Engler 430.

Around Peter's Hut, 11,500 ft., No. 22.

Recorded also from Abyssinia, Elgon (13,000 ft.), the Aberdares, West Kenya Mountain and summit of Kinangop (12,750 ft.), and from the Shira Mountains (13,000 ft.).

Helichrysum Kilimanjari *Oliv.* in Trans. Linn. Soc. Bot. Ser. 2, 2 : 338 ; Engler 429.

Around Peter's Hut, 11,500 ft., No. 52. Only represented with certainty from Kilimanjaro (*Johnston* No. 36) and Shira Mountains (*Haarer* Nos. 2, 349). Welwitsch records (Cat. p. 562) the same species from Angola, but the Angola specimen in the Kew Herbarium, which has been examined, must be regarded as a distinct though allied species.

Stoebe kilimandscharica *O. Hoffm.* in Engl. Pflanzenw. Ost-Afrikas C : 411 (1895).

Near Bismarck Hut at 8500 ft., material not in flower, No. 2.

Frequent on Elgon in the heath zone, bush and forest land, (8000–12,000 ft.), also on Mount Kenya in the Giant Heath association (10,000 ft.).

Artemisia afra *Jacq.*—F.T.A. 3 : 400 ; Engler 438.

Between 9000 and 10,000 ft., not common, No. 43.

Occurring on the Aberdares (10,000 ft.) and Kenya moors (12,000 ft.), on rocky ledges and thickets on Elgon (13,500 ft.), Ukambane (5000–6000 ft.), also in Southern Rhodesia, Angola, and extending to South Africa.

Cineraria kilimandscharica *Engl.* Hochgebirgsfl. Trop. Afrika 439 (1892).

In ravine just below Peter's Hut, growing on moist rocks, at 11,500 ft., No. 28.

Recorded from the Imatong Mountains at 8744 ft. (*Kew. Bull.* 1929 : 192), the Aberdares (up to 10,000 ft.) and Nandi Plateau, also with a local distribution on Elgon (12,000–13,000 ft.), the Nyika Plateau (7000 ft.), and Shira Mountains (12,000 ft.).

Senecio Schweinfurthii *O. Hoffm.* in Engl. Pflanzenw. Ost-Afrikas C : 417 (1895).

Growing around Peter's Hut, 11,500 ft., No. 24. The flowers are fragrant, with the scent of *Petasites fragrans* (Cotton).

Has been found on the Aberdares, and on the Shira Mountains (12,000 ft.). According to *H. Meyer* and *von Höhnel*, this species is one of the last flowering plants to occur in the highest zone on Kilimanjaro.

Senecio Cottonii *Hutch. et Taylor,** sp. nov. ; distinctissima aspectu *S. Battiscombei* R. E. & Th. Fries, sed foliis longe petiolatis integris, bracteis inflorescentiae haud lanatis, capitulis majoribus, ligulis minoribus differt.

Arbor usque ad 5 m. alta ; caulis simplex, foliis emarcidis dense obtectus. *Folia* caulis apicem versus conferta longe petiolata, oblongo-vel ovato-elliptica, basi rotundata, apice subacuta, circiter 35 cm. longa et 18 cm. lata, coriacea, integra, supra primum lanata demum glabrata, infra dense et crebre albo-lanata (costa longe sericeo-lanata), nervis lateralibus utrinque 15–18 utrinsecus leviter elevatis a costa primum ascendentibus demum patulis marginem versus evanidis et ramosis ; petioli complanati, circiter 23 cm. longi, dense et longe lanati, superne circiter 2 cm. basin versus 7 cm. lati et intra glabrescentes. *Inflorescentia* paniculata, plus minusve

* Described in collaboration with Mr. G. Taylor, of the Botanical Department, British Museum (Natural History), who had simultaneously determined Messrs. Piemeisel and Kephart's specimen to be a new species.

Senecio Cottonii Hutch. et Taylor. A, Leaf. B, Lateral branch of inflorescence. C, Rayflower. D, Disc-flower. E, Pappus seta.

pyramidalis, ramis lateralibus circiter 40 cm. longis et 30 cm. latis ; axis et pedunculi dense albo-lanati, bracteae inferiores oblanceolatae, usque ad 15 cm. longae et 3 cm. latae, superiores lineari-lanceolatae, extra tenuiter lanatae, intra subglabrae conspicue longitudinaliter striatae. *Capitula* radiata, aperte campanulata, circiter 2 cm. longa et 4 cm. diametro. *Involucri bracteae* 2-seriatae, oblongo-lanceolatae, acutae, 2 cm. longae, 7 mm. latae, extra fere glabrae ; involucelli bracteae circiter 10, lineares, 1–1·5 cm. longae, glabrae. *Flores radii* pauci et inconspicui ; ligula lineari-oblonga, apice biloba vel integra. *Flores disci* 1·5 cm. longi ; corallae tubus inferne cylindricus, superne leviter ampliatus. *Achaenia* circiter 6 mm. longa, striata, glabra. *Pappus* barbellatus, albidus, circiter 1 cm. longus.

Tanganyika Territory: Kilimanjaro; about Peter's Hut, 11,500–13,000 ft., Sept. 1, 1929, *Cotton & Hitchcock* No. 34 (type), No. 35, No. 36 (seedling) ; about 9000 ft., Aug. 1927, *R. L. Piemeisel and L. W. Kephart* No. 435.

[Besides dried herbarium specimens Mr. Cotton also secured a number of young plants which are now growing at Kew ; these have long-petiolate oblong-elliptic almost glabrous leaves.

Up to the year 1921 we knew only three species of arboreal Senecio, *S. adnivalis* Stapf, from Ruwenzori, *S. Johnstonii* Oliv., from Kilimanjaro, and *S. keniensis* Bak. f.* from Mt. Kenya, the last mentioned being imperfectly known and proving later to be a mixture. In that year the brothers R. E. and Thore C. E. Fries investigated these interesting plants in Eastern Africa, and through their careful researches we now know as many as nine species. Until recently only one species, *S. Johnstonii* Oliv., was known to occur on Kilimanjaro, and it came as a great surprise to find that Mr. Cotton, on a flying visit to the mountain, gathered what appears to be a very distinct new species (*see* notes on p. 108).

Below I give a list of the chief mountains of East Africa with the species known to occur on them. It will be observed that the Central group of mountains, the Aberdares and Mt. Kenya, harbour the greatest number of the species, and it is of considerable interest to note that in these mountains the intermediate habit-type, the " cabbage-like " forms, *S. brassicaeformis* and *S. Brassica* are found. It seems probable, therefore, that the peculiar and weird growth-form of these tree Senecios originated in this central range. Further investigation of the mountains between Lake Tanganyika and Lake Albert might possibly bring to light more of these interesting types of plants, and collectors in these regions should pay special attention to them.

* According to R. E. & Th. Fries this was a mixture; they now refer the trunk to *S. keniodendron* R. E. & Th. Fries, the inflorescence and the flowers to *S. Brassica* R. E. & Th. Fries, whilst the leaves of the latter had been included in the description of *Lobelia Gregoriana* Bak. f.

See R. E. & Th. Fries, Uber die Riesen-Senecionen der Afrikanischen Hochgebirge, in Svensk Botanisk Tidskrift 16: 321–340, figs. 1–9 (1922).

Mt. Ruwenzori : *S. adnivalis* Stapf.
Volcano Region (Mt. Ninagongo): *S. Erici-Rosenii* R. E. & Th. Fries.
Mt. Elgon : *S. elgonensis* Th. Fries.
Aberdares : *S. aberdaricus* R. E. & Th. Fries ; *S. Battiscombei* R. E. & Th. Fries ; *S. brassicaeformis* R. E. & Th. Fries.
Mt. Kenya : *S. keniodendron* R. E. & Th. Fries ; *S. Battiscombei* R. E. & Th. Fries ; *S. Brassica* R. E. & Th. Fries.
Mt. Kilimanjaro : *S. Johnstonii* Oliv. ; *S. Cottonii* Hutch. & Taylor. J.H.]

Senecio sympodialis *R. E. Fries* in Acta Horti Bergiani 9, 6 : 153 (1928)—ex descriptione.

Near Peter's Hut, 11,500 ft., Nos. 54 and 56.

This species, previously unrepresented at Kew, was described from the Aberdares, growing on the summit of Sattima at 12,000 ft. It is closely allied to *S. Meyeri-Johannis* Engl. from Kilimanjaro, from which it can readily be distinguished by the absence of dense indumentum on stem and leaves.

Euryops dacrydioides *Oliv.* in Trans. Linn. Soc. Bot. Ser. 2, 2 : 340 ; Engler 447.

Around Peter's Hut at 11,500 ft., very abundant. Of erect Cupressus-like habit and very conspicuous by reason of its showy yellow flowers, No. 60.

Confined to Kilimanjaro (10,000–14,000 ft.) and Shira (12,000 ft.).

Tripteris Volkensii *O. Hoffm.* in Engl. Pflanzenw. Ost-Afrikas C. : 419 (1895)—ex descriptione.

Bismarck Hut, 8500 ft., scrambling plant, very glandular, No. 10. Also collected by *Johnston* at 8500 ft., *Thomson* at 10,000 ft., and *Volkens* Nos. 857, 1142.

Landtia kilimanjarica *Hutch. et M. B. Moss*, sp. nov. ; affinis *L. Rueppellii* Benth. et Hook. f., sed foliis crasse dentatis (nec crenatis) supra glabris differt.

Herba humilis, rhizomate brevi et crasso radicibus crassis usque ad 12 cm. longis. *Folia* radicalia ovato-elliptica ad obovata, utrinque leviter angustata, apice obtusa vel subacuta, basi leviter decurrentia, 3–6 cm. longa, 2–3 cm. lata, supra viridia et glabra, infra crebre albo-lanata, marginibus crasse et irregulariter acute dentata, nervis lateralibus utrinsecus circiter 4 subito ascendentibus supra profunde impressis infra elevatis ; petioli lamina aequilongi, complanati et alati, basi vaginati, glabri vel pilis longis lanatis induti. *Capitula* subsessilia vel pedunculo usque ad 5 cm. longa, solitaria, circiter 4 cm. diametro. *Involucri bracteae* biseriatae, exteriores lineari-lanceolatae, circiter 1·5 cm. longae, extra leviter lanatae, interiores oblongae, apice acutae, 1 cm. longae et 3 mm. latae, glabrae. *Flores radii* circiter 1·7 cm. longi ; ligula oblonga, 5 mm. lata, apice 3-dentata. *Achaenia* glabra. *Pappi squamae* minutae, 1-seriatae.

Tanganyika Territory: Kilimanjaro, in wet places at 11,000 ft., Sept., *Cotton* No. 44 (type); above Kiboscho, 9400 ft., Jan., *Volkens* No. 1551. Shira Mountains, west Kilimanjaro, 12,000 ft., Feb., *Haarer* No. 1106.

This species has been found by previous collectors but has been referred to *L. Rueppellii* Benth. et Hook. (= *Arctotis Rueppellii* O. Hoffm.), a native of Abyssinia, from which it differs in the coarsely dentate leaves which are completely glabrous on the upper surface.

GENTIANACEAE.

Swertia crassiuscula *Gilg.*—F.T.A. 4, 1: 576.

Growing between grass tussocks above Bismarck Hut at 9000 ft., the flowers a pale grey-blue, while at 11,500 ft. in the ravine below Peter's Hut the flowers are a darker blue, Nos. 39 and 40.

From the Aberdares (10,000 ft.) and base of Kenya (a larger-flowered form), in short grass and bush land on Elgon (8000–10,000 ft.), and also from the Shira Mountains (12,000 ft.).

CAMPANULACEAE.

Wahlenbergia kilimandscharica *Engl.* Hochgebirgsfl. Trop. Afrika 412 (1892).

Growing between grass-tussocks above Bismarck Hut, No. 14.

Known only from Kilimanjaro; *Johnston* No. 155; *Volkens* No. 866; *Haarer* No. 176.

SCROPHULARIACEAE.

Bartsia Petitiana *Hemsl.*—F.T.A. 4, 2: 460; Engler 384.

Growing near Peter's Hut at 11,500 ft., No. 37.

From various localities in Abyssinia reaching an altitude of 12,000 ft. on Mount Chillalo, the Aberdares (10,000 ft.), western Kenya and the Laikipia escarpment (a sweetly scented pink-flowered herb growing in grass at 7600 ft.), and Elgon (12,000–13,000 ft.) where the flowers are said to be purplish. According to *Johnston* the same species occurs on the upper slopes of Cameroons Mountain, with bluish-mauve flowers, at 8000 ft. altitude.

Bartsia kilimandscharica *Engl.*—F.T.A. 4, 2: 461; Engler 384.

A yellow-flowered herb growing below Peter's Hut from 10,500 ft. to 11,000 ft., No. 38; *Volkens* No. 1178; *Johnston* No. 125.

Growing in short grass land at 11,000 ft. on Elgon (*Snowden* No. 458); the species is also found on the Shira Mountains (*Haarer* No. 1115).

SELAGINACEAE.

Hebenstreitia dentata *L.*—F.T.A. 5: 265; Engler 378.

Frequent from 8500 ft. and extending to Peter's Hut, 11,500 ft., Nos. 33 and 41; also a rose-coloured form found high up near Peter's Hut, No. 25.

A very variable and widespread species occurring throughout Abyssinia (9665 ft. on Mount Zuquala), in Eritrea, on Mount Kineti in the Southern Sudan (18 inches high growing in mountain meadows

between 8000 and 10,000 ft.); common on the Aberdare Range (7000–14,000 ft.) and Kinangop, where it is a bush 3½ ft. high, Ruwenzori, Karagwe (4000–5000 ft.) and Elgon (10,000 ft.).

On Kilimanjaro (12,000 ft.) *Johnston* reports two forms: the most frequent has whitish pink flowers with a crimson dash in the centre, while the other, doubtless a variant, has deep mauve flowers. The same species occurs in Nyasaland on the Nyika Plateau (8000 ft.) and Milanje, in Southern Rhodesia and Angola, and is widespread throughout South Africa.

Selago Johnstonii *Rolfe*.—F.T.A. 5: 269; Engler 379.

Below Peter's Hut, 11,000 ft., No. 47.

A low herb with pinkish flowers: this species is only known from Kilimanjaro and was collected at 11,000 ft. by *Johnston* in 1884.

Labiatae.

Micromeria biflora *Benth.*—F.T.A. 5: 452; Engler 364.

Near Peter's Hut, between 11,000 ft. and 11,500 ft., No. 53.

Widespread throughout Abyssinia and Nubia from sea level to 6665 ft. on Mount Zuquala, collected from Eritrea at 6000 ft. on Mount Bizen, the Red Sea Hills (3600 ft. at Erkowit, a small bush rather like a whortle-berry) and Somaliland; very common on Jebel Marra on the great central plateau, 9000 ft., and higher zones, 9500 ft., this was one of the few flowering plants collected from the top of Mount Kineti at an altitude of 10,414 ft. (*Kew Bull.* 1929: 193). In East Tropical Africa the plant occurs on Kinangop (8500 ft.), Ruwenzori (up to 7000 ft.), and the mountains of Uganda, Kenya, Tanganyika and Nyasaland, extending to Southern Rhodesia and Angola. The species is also reported from the Cameroons Mountain up to 10,000 ft.

Iridaceae.

Dierama cupuliflorum *Klatt* in Decken Bot. Ost-Afr. 73, t. 3; see N. E. Brown in Journ. Roy. Hort. Soc. 1929: 200.

In grass meadows just above forest zone at 9000 ft., No. 17.

Kilimanjaro: Marangu, 5100 ft., *G. Volkens* No. 983; 8300 ft. and 10,000 ft., *H. H. Johnston* No. 22; *Haarer* No. 1594; Nyika Plateau, 6000–7000 ft., *A. Whyte* No. 250.

Gramineae. (Det. F. Ballard).

Anthoxanthum nivale *K. Schum.* in Engl. Pflanzenw. Ost-Afrikas C. 107 (1895).

Near Peter's Hut, 11,500 ft., *Cotton & Hitchcock* No. 62.

Found also by *Johnston* No. 127 at 13,200 ft., *Volkens* No. 973 at 9000 ft.: and in the Shira Mountains at 10,000 ft., *Haarer* No. 1122.

Occurs also in the Aberdares, Mount Kenya and in W. Ruwenzori. J. C. Rammell states that in the Aberdares the plant is worn around the neck for its scent.

Koeleria convoluta *Hochst. ex Steud.* Syn. Pl. Glum. 1 : 293 (1854).

Near Peter's Hut, 11,500 ft., *Cotton & Hitchcock* No. 63.

Found also at Mawenzi at 13,000 ft. by *Volkens* No. 1351 : Marangu at 7300 ft., No. 921 ; on the Kifinika Volcano at 10,000 ft., No. 1855, and in the Shira Mountains at 10,000 ft., by *Haarer* No. 1122A.

Occurs also in the Cameroons, Abyssinia, Aberdare and Kenya Mountains and in Uganda on Mount Elgon. Mr. D. K. S. Grant (Kenya) states that this is a good fodder grass.

Pentaschistis borussica *Pilger* in Notizbl. Bot. Gart. Berlin 9 : 517 (1926).

Near Peter's Hut, 11,500–12,500 ft., *Cotton & Hitchcock* No. 66.

Found also at Mawenzi at 13,000 ft. by *Volkens* No. 1368 ; in the Shira Mountains at 12,000 ft. by *Haarer* No. 1130.

Occurs also in Kenya Colony, on the west side of Mt. Kenya, and in Uganda on Mt. Elgon.

Pentaschistis borussica var. **minor** *Ballard et Hubbard*, var. nov. ; a typo panicula contracta, ramificationibus vix glandulosis vel eglandulosis, spiculis aristisque minoribus differt.

Foliorum laminae marginibus eglandulosis scaberulisque vel levissime glandulosis. Panicula angusta, contracta, erecta, 5–7 cm. longa, ramificationibus levissime glandulosis vel eglandulosis atque laevibus. Spiculae 4·5–5·3 mm. longae ; lemmata ad 2·5 mm. longa, setis lateralibus ad 2 mm. longis, arista ad 5·5 mm. longa.

Kilimanjaro : near Peter's Hut, 11,500 ft., Sept. 1929, *Cotton & Hitchcock* No. 64.

Agrostis Volkensii *Stapf* in Kew. Bull. 1897 : 289.

Near Peter's Hut, 11,500–12,500 ft., *Cotton & Hitchcock* No. 69.

Found also on Kifinika Volcano at 10,000 ft. by *Volkens* No. 1856 ; in the Shira Mountains at 13,000 ft. by *Haarer* No. 1129.

Agrostis trachyphylla *Pilger* in Notizbl. Bot. Gart. Berlin 9 : 512 (1926).

Near Peter's Hut, 11,500 ft., *Cotton & Hitchcock* No. 65.

New to Kilimanjaro ; occurs also in Kenya Colony, on the west side of Mt. Kenya.

Poa leptoclada *Hochst. ex A. Rich.* Tent. Fl. Abyss. 2 : 422 (1851).

Near Peter's Hut, 11,500–12,500 ft., *Cotton & Hitchcock* No. 68.

Found also at 9000 ft. by *Volkens* No. 1117.

Occurs also in Kikuyu, the west side of Mt. Kenya and Aberdares in Kenya Colony, Abyssinia, and Kiyimbila in Tanganyika Territory.

Festuca abyssinica *Hochst.* var. **intermedia** *St. Yves* in Notizbl. Bot. Gart. Berlin 9 : 1132 (1927).

Near Peter's Hut, 11,500–12,500 ft., *Cotton & Hitchcock* No. 67.

Found also by *Johnston* No. 151, at 13,000 ft. ; and in the Shira Mountains at 12,000 ft. by *Haarer* No. 1131.

Occurs also in Kenya Colony, Mts. Aberdare and Kenya.

XIII.—ON THE FLORA OF THE NEARER EAST: V.*

W. B. Turrill.

Oxytropis olympica *Turrill*, sp. nov.; ab *O. Pallasii* Pers. floribus purpureis distinguitur.

Planta perennis, caulibus vix elongatis numerosis e radice lignosa caespitosis patentissime denseque albo-pilosis. *Folia* omnia evoluta usque ad 6 cm. longa, longe sericeo-pilosa, foliolis circiter 8-jugis in foliis primariis ellipticis vel oblongo-ellipticis 5–6 mm. longis et 3 mm. latis in foliis secundariis oblongo-linearibus usque ad 9 mm. longis 2–2·5 mm. latis; petiolus 1·5–2·3 cm. longus; stipulae lanceolatae vel lanceolato-ovatae, herbaceae, 6 mm. longae. *Capitula* usque ad 2·1 cm. longa et 1·6 cm. lata. *Pedunculi* 3–4 cm. longi, patentissime denseque albo-pilosi vel pilis paucis sub capitulo et in inflorescentia fuscescentibus instructi. *Bracteae* lanceolatae, 5 mm. longae, albo-nigroque pilosae. *Calycis* fere tubuloso-campanulati albo-nigroque pilosi tubus 5 mm. longus; dentes subulati 4 mm. longi. *Vexillum* 14 mm. longum, lamina late ovata 9 mm. lata leviter retuso-emarginata purpurea. *Alae* 12·5 mm. longae, inaequaliter retuso-emarginatae. *Carina* 12 mm. longa, in mucronem 2 mm. longum subito contracta. *Carpellum* fere cylindricum 9 mm. longum, dense adpresse sericeo-villosum, 22-ovulatum. *Legumen* immaturum in calyce omnino sessile dense albo-sericeum.

Thessaly: Mt. Olympus, 2740 m., 26.6.1929, *Giuseppi* 47.

This taxonomically and phytogeographically interesting species is so closely related in all morphological characters to *O. Pallasii* Pers., that it is described as a new species with some hesitation. In addition to the obvious difference in flower colour our specimens differ from those of *O. Pallasii* in having the stems somewhat less developed (though individuals of *O. Pallasii* are sometimes depauperated in this respect), the bracts on the whole slightly broader, the standard, including the claw, somewhat broader, and the carpels with (at least sometimes) more ovules. It is, however, impossible to say whether these are relatively constant distinctions or mere individual fluctuations.

Apparently no species of *Oxytropis* has been previously recorded from the Thessalian Olympus, and all the species of this genus hitherto known from the Balkan Peninsula occur to the north or west of Thessaly.

O. Pallasii Pers. is known from the Crimea (Tauria), Caucasus, and Transcaucasus (Georgia), and has also been recorded, somewhat doubtfully, from Bessarabia. The isolated geographical position of *O. olympica* suggests that we have here one more relict type of a flora rich in old or relict species, of which *Ramondia* (*Jankaea*) *Heldreichii* Benth. et Hook. fil. is the best known example.

Asperula arvensis *L.*

Seeds of this species were collected by B. Gilliat-Smith near Tabriz, N. Persia, and sown in the Herbarium Experimental

* Continued from *K.B.* 1929, p. 235.

Ground at Kew in the spring of 1928. Two weeks after sowing the seedlings had the following characters: *Primary root* 2–3 cm. long, dull yellowish in colour, much branched. *Hypocotyl* erect, terete, white below, pale greenish or tinged with purple anthocyanin above, 2–3 cm. long, glabrous. *Cotyledons* with blades very broadly ovate to practically orbicular, 3 to 4 mm. long and 3 to 4 mm. broad, glabrous, apex rounded, usually very slightly retuse, petioles to 2 mm. long, midrib and lateral veins not visible above, just distinguishable below.

Campanula hercegovinica *Degen et Fiala* in Oesterr. Bot. Zeitschr. xliv. 303 (1894).

Hercegovina: roadside on way to Mt. Prenj, 150 m., 1929, *Giuseppi* 78.

This species, so far as is known, is endemic to Hercegovina, but has hitherto only been recorded from much higher altitudes (1150 to 2000 m.), except for one collection by K. Maly [Wiss. Mitt. Bosn. u. Herz. xii (1912)]. Giuseppi's material emphasizes the close relationship between *C. hercegovinica* and *C. crassipes* Heuff. from the Banat and Serbia.

Heliotropium europaeum *L.* var. ?

Thessaly: Lithochoron, sea-level to 300 m., *Giuseppi* 70.

This widely distributed species has not yet been subjected to adequate taxonomic analysis. The various floras refer to the ovary or nutlets as glabrous to hispid. The specimen from Thessaly quoted above has the nutlets more densely hairy than in any specimen of the species at Kew or the British Museum. It may possibly be included in the var. *tenuiflorum*, as understood by Boissier [Flor. Or. iv. 130 (1879)], whose nutlets are described as "magis hispidae." Gussone in his original description [Fl. Sic. Prodr. i. 205 (1827)] does not describe the nutlets.

Anchusa officinalis *L.* var. **ochroleuca** *Boiss.* Flor. Or. iv. 152 (1879).

N. Macedonia, Babuna Pass, S.E. of Bitolia, roadside, 800 m., 19.6.1929, *Giuseppi* 11.

This very definite colour variety is known only from Macedonia. Possibly de Fredrichsthal's material collected "inter Istib et Perlepe (substr. tertiar.)" and recorded by Grisebach [Spic. flor. rumel. et bithyn. ii. 98 (1844)] as *A. ochroleuca* M. Bieb. belongs to the same variety [see Guşuleac, Die europäischen Arten der Gattung Anchusa Linné 31 (1927)].

Convolvulus lanatus *Vahl* Symb. i. 16 (1790).

This species is known to be fairly common in Lower Egypt and in parts of Arabia and Syria. The only record for the Balkan Peninsula is that given by Sibthorp [Prodr. i. 136 (1806), Fl. Gr. t. 202 (1819)] for Crete, without exact indication of the locality. Thanks to the kindness of Dr. G. C. Druce I have been able to

examine at Kew the specimens of *Convolvulus* from the Sibthorp herbarium. There are two sheets of *C. lanatus* Vahl in the collection, but nothing to indicate whence they came. The figure in the Flora Graeca was surely made from a living specimen and this might quite well be one of those now preserved in the Sibthorp collection. The locality is very definitely printed as " In Cretae collibus siccis," though the species has not since been found in Crete. If it really is a Cretan species it is interesting as being one of the very few definite floristic links between the Balkan Peninsula and Egypt. There is an undecipherable word on the label which may be the name of a locality.

Linaria peloponnesiaca *Boiss. et Heldr.* var **parnassica** Hal. Oesterr. Bot. Zeitschr. xlvii. 324 (1897).

Thessaly : Mt. Olympus, 900 to 2400 m., 26.6.1929, *Giuseppi* 30.

Attention is called to the very considerable range in indumentum quantity and kind in this species as understood by Halácsy, Hayek, and other authors. The specimen from Mt. Olympus quoted above is remarkable for the long, distinct, white hairs, giving the inflorescence axis and calyces a shaggy appearance. It may well be that further collecting would suggest a greater subdivision of the species than is at present reasonable.

Wulfenia Baldacii *Degen* in Oesterr. Bot. Zeitschr. xlvii. 408 (1897).

N. Albania : deep gorge and rocks on Cafa Stogut, 9.7.1929, *Giuseppi* 76, 76a.

The specimens under the former number grew on the north-facing side of the gorge and agree with the original specimens of Baldacci as preserved at Kew and the British Museum. On the other hand the specimens under 76a were found in cracks of the cliff face on the side facing south. They may be characterized in the following words ; a planta typica foliis longioribus in parte inferiore gradatim attenuato-cuneatis fere integris superiore lobulis acutius dentatis, calycis segmentis longioribus, corolla breviore praecipue differt. Since there are specimens in the British Museum collected by Dörfler which are intermediate between these and the typical plants collected by Baldacci, the former are considered as only a habitat form. The phytogeographical interest of the genus has been considered in Turrill, *The Plant Life of the Balkan Peninsula* 296, 459 (Oxford, 1929).

Carpinus orientalis *Mill.*

Seeds of this species, collected near Varna, Eastern Bulgaria, by B. Gilliat-Smith, were sown in the Herbarium Experimental Ground in pots in the cold frame on 24.3.1925. One seed germinated in the spring of 1926 and 7 in the spring of 1927. *Primary root* of the seedling about 3 cm. long, tapering, whitish, giving off few lateral roots. *Hypocotyl* 2–2·2 cm. long, terete, minutely pubescent, reddish. *Cotyledons* dark glossy green above, pale dull green below, very broadly obovate, completely rounded at the apex, with a marked

sagittate base, 6–7·5 mm. long, 4·5–6 mm. broad, with a short petiole 1–1·5 mm. long, glabrous except the petiole which is very finely pubescent and scarcely grooved, rather thick and the veins scarcely visible in the living condition. The *first foliage leaves* appear early, when the seedlings are 2 to 2·3 cm. high, and though small are very similar to the leaves of the adult tree in shape, nervature, margin, apex, and base. The first two are opposite in a plane at right angles to the cotyledon plane, and they have each a pair of small, membranous, pale brown, pubescent stipules. The *stem* soon becomes woody, erect, terete, and branches in the second year.

Carex troodi *Turrill*, sp. nov. ; a *C. diluta* M. Bieb. habitu minore, spiculis masculis fructiferisque brevioribus ovatis recedit.

Planta nana, dense caespitosa. *Culmi* usque ad 7 cm. alti, graciles, obsolete triquetri, glaberrimi, longitudinaliter sulcati. *Folia* omnia basalia, lanceolato-linearia, apice gradatim acuminata, circiter 4 cm. longa, 3 mm. lata, inferne plicata, deinde plana, glauco-viridia, rigida vel subrigida, glaberrima, margine integerrima haud serrulata, vaginis pallidis vel atropurpureis striatis. *Spiculae* 2–4, saepissime infima foemina in foliis occulta ; terminalis mascula ovata vel anguste ovata, vix 1 cm. longa, 5–6 mm. diametro, pedicello 1·3–1·5 cm. longo laeve gracile instructa ; laterales 1–3 foeminae anguste ovatae, fructiferae 5–9 mm. longae, 3–5 mm. diametro, 5–18-florae, remotae, breviter pedunculatae ; bracteae inferiores foliaceae anguste lineares, usque ad 2 cm. longae, margine in parte superiore minutissime serrulatae, superiores setaceae, basi vaginatae. *Squamae* masculae obovata-ellipticae, apice rotundatae, haud vel vix mucronatae 4·5 mm. longae, 2·5 mm. latae, castaneae, dorso tricostato pallidae ; foeminae ovatae, 3 mm. longae, 2 mm. vel fere 2 mm. latae, e dorso viride tricostato leviter mucronatae. *Utriculi* ellipsoidei, adaxiale plus minusve plani, abaxiale convexi, 3·5 mm. longi rostro bidentato vix scabridulo fere 1 mm. longo incluso, glabri ; stylus ramis tribus 2·5 mm. longis inclusis 3·5 mm. longus.

Cyprus : Troodos, Chionistra, 1900 m., sent by the *Forestry Department, Cyprus*, July, 1928, to Dr. G. C. Druce, F.R.S.

This interesting dwarf sedge has been somewhat difficult to classify. It appears to be most closely related morphologically to *C. diluta* M. Bieb., a species with a wide distribution in the Pontic Lands of South Russia, Crimea, Caucasus, Caspian, and Armenia to North Persia, Afghanistan, N. Kashmir, and Central Asia. Varieties of the species are recorded from Morocco, Greece, and Crete [see Kükenthal in Engler's Pflanzenr. iv. 20, 659 (1909)]. Holmboe [Studies on the Vegetation of Cyprus 42 (1914)] records *C. diluta* from " Shrubby places at Vrysi tu Eroton on the peninsula of Akamas," the specimens, which I have not seen, being of his own collecting. The species here described is a dwarf plant, with a habit which is correlated with the high altitude of its habitat. A

remarkable feature is the relatively short, more or less ovate, male spikelets with their glumes tending to spread somewhat. These essentially male spikelets sometimes have a utricled female flower at the base.

Hordeum spontaneum *K. Koch* Linnaea xxi. 430 (1848). *H. ithaburense* Boiss. Diagn. Ser. i. xiii. 70 (1855).

An interesting extension of the known range of this grass is provided by a specimen collected by M. Gandoger, Herbarium creticum, 1914, No. 638, in Herb. Kew. The specimen is named *Secale creticum* L., and the locality is given as Provincia Sitia, Toplon, 14/9. So far as is known this is the first record of the species occurring wild in Europe. Aznavour [Mag. Bot. Lap. x. 21 (1911)] records the species as having been collected "le long du chemin de fer, à Yarim-Bourgas (non loin de Halkali)." It was almost certainly introduced here from Asia Minor.

The species is known from Asia Minor, Syria, Palestine, Iraq, Persia, Afghanistan, Baluchistan, Transcaucasia, Arabia Petraea, Turkestan, Bokhara, Cyrenaica, and Marmarica. References to the possible connections between *H. spontaneum* and the cultivated barleys are made by Ascherson and Graebner, Syn. Mitteleur. Flora ii. 723 (1901), R. Regel, On the problem of the origin of the cultivated barley, in Bull. Appl. Bot. x. 612 (Leningrad, 1917), and N.I. Vavilov, Studies on the origin of cultivated plants, in Bull. Appl. Bot. xvi. ii. (1926).

XIV.—MISCELLANEOUS NOTES.

C. E. Salmon.—By the death of Mr. C. E. Salmon, at Reigate, on January 1st, British Botany has sustained an irreparable loss and Kew has lost a valued correspondent and generous contributor. Charles Edgar Salmon was born on November 2nd, 1872, and was an architect by profession. He had devoted his leisure hours for most of his life to British field botany and had specialized in his own county. On his last visit to Kew he informed the writer that a considerable proportion of the manuscript for his Flora of Surrey was already set in type. Mr. Salmon was also an authority on the genus *Limonium* (*Statice*), and had latterly taken considerable interest in the study of fruits and seeds. His delightful personality will be greatly missed by all his friends. His herbarium has been bequeathed to the British Museum (Natural History). A photograph, notice, and partial list of his papers have been published in the Journal of Botany, lxviii., February, 1930. W. B. T.

Botanical Magazine.—Part iii of Vol. cliii (1927) has recently been published and contains the following illustrations:—*Hippeastrum candidum* Stapf (t. 9184), a new species from Tucuman, Argentina, allied to *H. solandriflorum* Lindl.; *Meconopsis betonicifolia Baileyi* Cotton (t. 9185), from S.E. Tibet; *Rhododendron Forrestii* Balf. f. ex Diels (t. 9186), a native of the mountains of the frontier

of Yunnan, Tibet and N.E. Burma ; *Acradenia Frankliniae* Kippist (t. 9187), the only known member of the genus, which occurs in a small area in Western Tasmania ; *Ranunculus psilostachys* Griseb. (t. 9188), a handsome buttercup from the Balkan Peninsula ; *Primula Baileyana* Kingdon Ward (t. 9189), from S.E. Tibet ; *Rhododendron Wasonii* Hemsl. & Wilson (t. 9160), a native of the high mountains of Western Szechuan ; *Sarcopodium Lyonii* Rolfe (t. 9191), from Luzon, Philippine Islands ; *Prunus* (*Cerasus*) *pilosiuscula* Koehne (t. 9192), from China ; *Tsuga chinensis* E. Pritzel (t. 9193), a native of Central China, and *Orobanche uniflora* Linn., f. *nana* (t. 9194), a native of N. America.

Chinese Medicine in Malaya.*—The author is an accomplished pharmacologist with long experience under the Government of India, and joint author with Dymock and Warden of the *Pharmacographia indica*.

Some 400 vegetable drugs used by the Chinese in the Malay Peninsula, the botanical source of which has been determined, are described, along with a few others unidentified, and about 40 of animal or mineral origin. The material for this study was collected from Chinese druggists in Malaya by Mr. I. H. Burkill when Director of Gardens, Straits Settlements. Modern herbalists in this country collect and sell probably some 170 species, but the Pharmacopœia of the Chinese, like that of the Greeks in the time of Dioscorides, is perhaps still almost coextensive with the vegetable kingdom known to them. Many of the medicines are listed in the annual reports of the Chinese Imperial Maritime Customs, but Chinese residents in Malaya make use also of many Indian and local drugs. The list includes both official drugs of the classical Chinese Herbal (*Pen ts'ao kang mu*), of which the most renowned are the Ginsengs, and very many herbs, roots and fruits of domestic use whose functions are presumably indicated to the herbalist under the doctrine of signatures. Amongst the animal substances the edible birds' nests rank highest, although, being of seaweed origin, they might claim a place in the other kingdom.

The vernacular names are given both in Chinese characters and in Romanized Mandarin script, with in some cases the local equivalents as pronounced in Malaya. There is an adequate index, and references to published works are quoted under each medicine. The information here brought together will thus be of great use to workers in this field of medical research, who have been unfortunately deprived of an expected standard work on the Economic Products of China by the untimely death of Sir Alexander Hosie.

J. M. D.

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* On Chinese Medicine: Drugs of Chinese Pharmacies in Malaya, by David Hooper, LL.D., F.C.S.—The Gardens' Bulletin, Straits Settlements, vol. vi, part 1 (Nos. 1–5), Dec. 1929, pp. 1–163. To be purchased at the Botanic Gardens, Singapore, price $2.50.

Grass Cakes.—The conservation of young grass in a dried and pressed condition for winter use is a development of grassland farming that promises well for the stock-breeder. Recent research has shown that newly-cut grass, three to four inches high, has a nutritive value much greater than that of hay and equal to that of other protein concentrates, such as oil-cake or meal. The botanical composition of the pasture would appear to be a secondary consideration, though a mixture of grasses is desirable. Most grasses suitable for fodder are more palatable in the stage recommended for cutting, and many others are good for feeding in this young condition which become useless or inferior for the purpose when old, as when left to grow for hay. A primary requirement is careful and regular manuring to produce thick and vigorous growth, following the successive mowings at the requisite height.

Cutting and collecting machines are necessary, and another point of economic importance, yet to be decided, is the cost of production and the price at which the cakes can be sold to compete with oil-cakes. They are not yet on the market and it is early to express an opinion as to the possible advantages of their use in hot countries where a long dry season occurs. Favourable results have, however, been obtained in research work at the School of Agriculture, Cambridge, and field work at the Agricultural Research Station of Imperial Chemical Industries, at Jealott's Hill. The grass is pressed into cakes of a density of approximately 56 lbs. per cubic foot or 40 cubic feet to the ton, and the results indicate that, whatever the marketing possibilities may be, the value for stock of young grass, preserved in the form of cake, is established. The fresh grass appears to lose none of its feeding value during drying and pressing.

A similar practice—under perhaps more primitive conditions—appears to have been long established in principle in the grassland husbandry of Switzerland, in the cultivation, cutting (at a height of 4 inches), and harvesting of young and tender herbage for winter use. This provision of winter food for farm animals in most temperate countries is met by the conservation of grass as hay or ensilage, the storage of root crops, and the use of concentrated food such as oil-cakes (including Cotton seed, Soy-bean, Linseed, Groundnut and Coconut) or foods such as "Molascuit," "Molassine" and "Copraline." These patent foods consist of chopped Sugar-cane megasse, Sphagnum moss, and Coconut kernel with sugar-cane, respectively, mixed in the first two cases with molasses and in the third with Demerara sugar.

The subject is more fully discussed in the Essex Farmers' Journal, Feb. 1929, "Dry Grass Cakes," (pp. 568-571); Tropical Agriculture (Trinidad), Dec. 1929, "Conservation of the Produce of Pastures" (in Great Britain), by Dr. H. E. Woodman (p. 332); and in the Journal of Agricultural Science, Jan. 1930, "Nutritive Value of Pasture; Pasture Grass Conservation"—by H. E. Woodman, J. W. Bee and G. Griffith (pp. 53-62). J. H. H.

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